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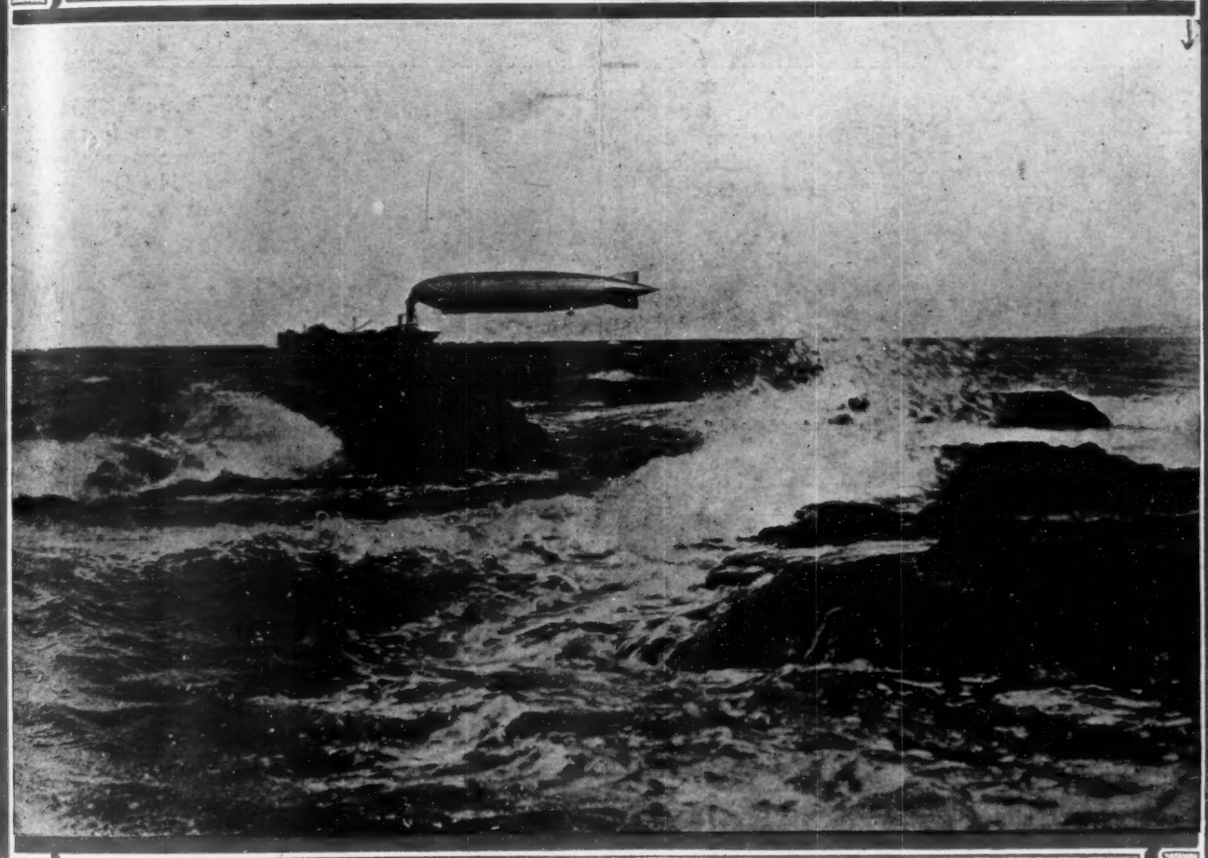

The U.S.A. Los Angeles at Bermuda
Wide World Photo

VOLUME XVIII

NUMBER 19

SPECIAL FEATURES

THE NEW PACKARD ENGINES

INTERNATIONAL AIR TRANSPORTATION

STABILITY AND CONTROLLABILITY OF AIRPLANES

GARDNER PUBLISHING CO., Inc.
HIGHLAND, N. Y.
225 FOURTH AVENUE, NEW YORK

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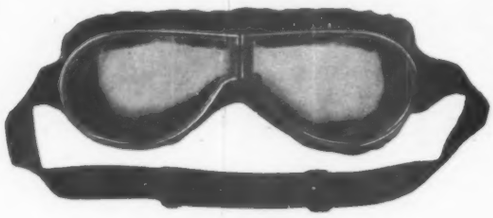

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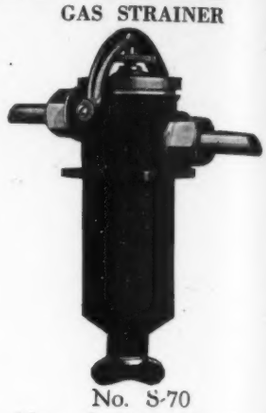

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MAY 11, 1925

AVIATION

VOL. XVIII. NO. 19

Published every Monday

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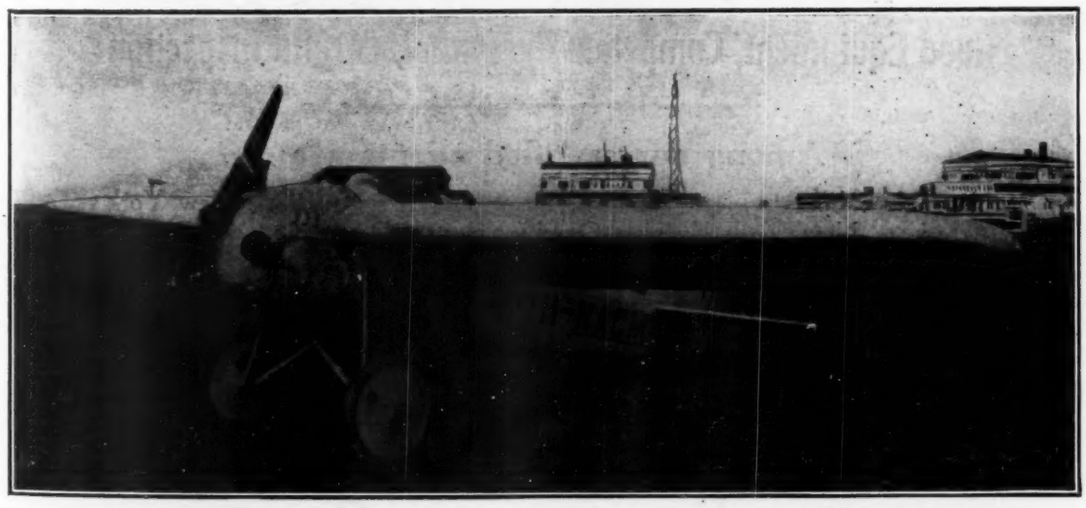
AEROPLANE WORKS — PANDER

THE HAGUE (HOLLAND)



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VOL. XVIII | MAY 11, 1925 | No. 19

Exploring Airplanes

THE year 1925 bids fair to be the year in which airplanes become recognized as essential exploration aids. There is a party in the Brazilian jungle at the present time that has been using a flyingboat. The McMillan expedition will take three machines into the Arctic.

In both the Rice and McMillan expeditions airplanes are used principally for aerial mapping. This enables previously unknown territory to be accurately mapped by explorers, the first time it is covered. This is in great contradistinction to previous similar expeditions. Everyone remembers the excitement caused by a slight error on a sketch made during one of the Roosevelt expeditions, a river apparently running uphill. In the Arctic, Crocker Land has been a subject of debate for several decades because all sketch maps differ as to its location and no one has been able to reach the place where it is supposed to be.

A sporting element as well as exploration will enter the Arctic aircraft plans this year. A blimp and two flyingboats are in the race to be the first to fly to the pole. This cannot be classed as pure exploration, although the collection of data seems to be a secondary consideration with both parties.

It is to be hoped that the McMillan-Navy expedition will not be drawn into this contest, as this would undoubtedly seriously detract from their value in exploring Axel Heiberg and Crocker Land. John L. Reinartz, the radio operator, will probably maintain constant contact with civilization every day, via short wave lengths. This will keep the expedition before the world without the aid of spectacular stunts. The object of the McMillan-Navy expedition is scientific exploration and not a test of aircraft.

Airship Moorings

IT is only a little over a year since the U. S. Navy airship Shenandoah broke away from its mooring mast. We now have the similar case of the British R-33. Although the detailed causes of this last breakaway are still lacking, it is perhaps worth while trying to find some feature of the present system of mooring to a mast, which might be fundamentally responsible for such a strange repetition of the same accident. The impression received by the public has apparently been colored largely by the dramatic nature of these two episodes. In both cases the airship broke away in a terrific storm which did great damage to shipping and other property. In each case although badly damaged, the commander and crew of the airship made a gallant fight against great odds and brought the airship safely home again under its own power. This has naturally created a feeling of general respect for the airworthiness of the airships themselves, with a corresponding tendency to consider the mooring mast as yet not fully perfected.

From a technical standpoint however, the conclusion should seem to be exactly the opposite. In each case the breakaway occurred in a wind of very high velocity. It must also be admitted that the ship was designed to be able to stand considerably more strain, providing it was headon resistance. Unfortunately this is not the criterion for rigidity or stability in mooring at present. The fundamental trouble is that the center of pressure for small angles of yaw on an airship of this type is considerably in advance of the nose. In other words, paradoxical as it may seem, when the wind strikes the side at a small angle, the point of application of the resultant force is not on the ship at all, but a certain distance ahead of it. The result is, that even when moored to the tip of the nose, the ship will still not lie back, but keeps trying to yaw to one side or the other.

The difficulty is much increased by high winds which bring greater gustiness, thus adding the effect of inertia to the already inherent instability of the airship itself. Add to this the fact that these side forces in yaw are far greater in magnitude than the headon resistance and the fundamental cause of these breakaways is at once apparent, no matter what the direct detailed causes may have been. Recent aerodynamic developments show that it is possible, by proper attention to the details of airship design, to move the center of pressure not only well behind the nose of the airship, but almost back to its own center of gravity This should be of very great help in mooring such craft safely in the open in all kinds of weather.

"Beware—Government Flying Field"

SIGNS with the above warning will probably be the next step in the government cooperation with commercial aviation. The new rules for War Department flying fields, printed elsewhere in this issue, will startle the owners of private aircraft. They say plainly: If you operate an airplane for profit, you must not, under any circumstances, approach a government field. If you are a private owner and want to visit an Air Service Field occasionally, you must secure the permission of the commanding officer, assure him that your plane is housed in a privately owned hangar and that no assistance will be asked by you as to maintenance, repair or operation—and then furnish a bond for $5,000 to protect the government against damage to property.

Such regulations are not only absurd but are almost Prussian in their severity. They can only be the result of more "arm chair direction." Protests against barring fliers from the flying fields of the Government that are paid for and supported by public money should be addressed to the Secretary of War. If you feel that these rules are improper and will tend to retard flying, write and say so.

International Air Transportation

By LADISLAS D'ORCY

Among the numerous air lines which connect the principal cities of Europe with one another there is one which stands out from the rest, not only by reason of its far flung services, but also because it represents an interesting solution of international air navigation. This company, the International Airways (Compagnie Internationale de Navigation Aérienne) or "C.I.D.N.A.," was formed in April, 1920, under the name of Franco-Rumanian Airways, for the purpose of establishing regular aerial communications between France and the countries of the Little Entente (Czechoslovakia, Poland and Rumania). Its sponsor was M. Aristide Blank, a Rumanian banker, who furnished almost the entire initial capital of the company, which was 3,000,000 francs (at par value). General Duval, who had been chief of air service at French General Headquarters during the latter part of the War of 1914-18, was elected president of the company in view of his wide and varied experience in aeronautics.

Political Negotiations

Even before the company had been formed, negotiations were started with the countries of the Little Entente with a view to obtaining from them government assistance in the form of subsidies and exclusive postal contracts for the services projected. This was successfully accomplished, thanks largely to the strong political support the company received in these negotiations from the French government. The latter also granted the C.I.D.N.A. a large subsidy and by the end of 1920 the first airway service started between Paris, Strasbourg and Prague, the capital of Czechoslovakia, a distance of 550 mi. The following year this line was extended to Warsaw (Poland), which increased its length to 900 mi., and small service stations were created at the four airports of call.

In consideration of the political difficulties the C.I.D.N.A. later experienced in operating this service, it is well to state at the outset that about two-fifths of the direct air route from Paris to Warsaw leads over German territory: 250 mi. between Strasbourg and Prague, and 120 mi. between Prague and Warsaw. No regular port of call in German territory was scheduled for this service, but the company's planes often landed for fuel at Nuremberg and at Breslau. Under the terms of the Treaty of Versailles Allied civil aircraft had the right to land anywhere in Germany without previous permission of that country and without reciprocal treatment on the part of the Allies until Jan 1, 1923, at which date Germany regained the sovereignty over her air space. It seems almost incredible that at the time when the Paris-Warsaw service was started nobody should have stopped to think that Germany would use this clause as a powerful lever for obtaining better terms in the so-called "discrimination rules" whereby German civil aircraft are distinguished from military—yet such was the case. Without having any agreement with the German government for insuring the future of its plans, the C.I.D.N.A. just went ahead with them, while Germany sat back and watched the calendar for the date when it could with impunity throw the monkey wrench into the machinery of international air transport from which it was excluded.

Airway Doubled

In 1922 the C.I.D.N.A. more than doubled the length of its air services by establishing a branch line from Prague via Vienna, Budapest and Bucharest, to Constantinople. The total personnel of pilots, mechanics, engineers, station superintendents, etc. now numbered 380 and the fleet of the company comprised 84 airplanes as against 57 for the previous year. The flying equipment was considerably improved by the purchase of higher powered ships, such as the Blériot-Spad type 66, with 400 hp. Lorraine engine, while the lower powered Salmson and Potez IX ships, with which the service started and which were converted war machines, were gradually put in reserve. Large repair depots were organized at Le Bourget (Paris), Prague and Bucharest, the last named being particularly well equipped for rebuilding machines from the ground up.

Germany

The year 1923 started with a warning from the German government that Allied civil aircraft would have to obtain from it special permission to fly over German territory and that those not observing this ruling would be confiscated. The C.I.D.N.A. decided to disregard this warning and to continue its services, acting therein as directed by the French government, which contended that Germany could not, under the terms of the peace treaty discriminate between Allied and other foreign civil aircraft. (By that time various Dutch, Scandinavian and Swiss air lines were running services into Germany, and before the end of the year a British company, the Imperial Airways, joined the lot.) However, Germany's stand was supported on the Council of Ambassadors by Great Britain which naturally was not at all anxious to help a commercial rival which through a series of agreements had practically obtained a monopoly of the best aerial trade route to the Near East. And so Germany stood pat and confiscated, one after the other, fourteen ships of the C.I.D.N.A. which suffered forced landings in German territory during 1923. To make matters still more unpleasant for the company, the German civil air authorities discontinued issuing weather forecasts for this route, which made the operation of airplanes often very hazardous.

Turkey

At the other end of the line, at Constantinople, the political sky was pretty dark too. Having, after the Treaty of Lausanne, been put in possession of the airport of San Stefano, which the Allies had built up near the Turkish capital, the Angora government suddenly decided in a burst of jingoism that henceforth only Turkish airway companies would be permitted to operate in Turkey.

It is greatly to the credit of the C.I.D.N.A. that in the midst of all these difficulties it not only did not get discouraged but methodically continued to carry out its plans. During 1923, Belgrade, the capital of Yougoslavia, was included as a stopping point in the Paris-Bucharest line and the Belgrade-Bucharest section was completely equipped for night flying. The latter service, which was officially inaugurated in September of that year, was the first of its kind to function anywhere in the world on a regular schedule.

Night Flying

On this 370 mi. long night route, three-engined Caudron planes are used. The latest type C81, is equipped with a central 400 hp. Lorraine engine and two 260 hp. Salmson engines in the wings. Eight passengers can be accommodated in a spacious cabin lighted by electricity and special holds are provided for hand baggage and mails. The operation of these ships has proved entirely successful, and the record of safety they are building up is gradually overcoming the reluctance of the traveling public to fly by night.

When the C.I.D.N.A. resumed its services in 1924—the company does not operate between Nov. 15 and March 15—the German ban against French civil aircraft not only continued to be in force but it was even extended to include British aircraft, which, during the previous year had been given preferential treatment for political reasons. As a result the Imperial Airways decided to suspend their London-Berlin service; but the C.I.D.N.A., with the approval of the French government, continued to fly over Germany.

This taboo incidentally furnished the company with some excellent publicity, for at the close of the flying season only one ship had had a forced landing out of 470 flights made over forbidden territory. The excellence of the equipment and of the maintenance service was thus strikingly demon-

strated under particularly trying circumstances which Germany hoped would play havoc with the company's commercial reputation. The nervous strain on the pilots charged with the responsibility of seeing the ships safely through to a friendly airport can, however, better be imagined than described.

Traffic

The last two years were excellent from the viewpoint of traffic, which progressed with leaps and bounds, particularly between Paris, Prague and Vienna. Whereas in 1922 the company's planes were rarely more than half loaded, in 1923 and 1924 the ships not only always took off with full loads, but the company had to refuse for lack of cargo space as much as three-fifths the freight it was offered at the various airports.

The following table shows the development of the company's business in three years time:

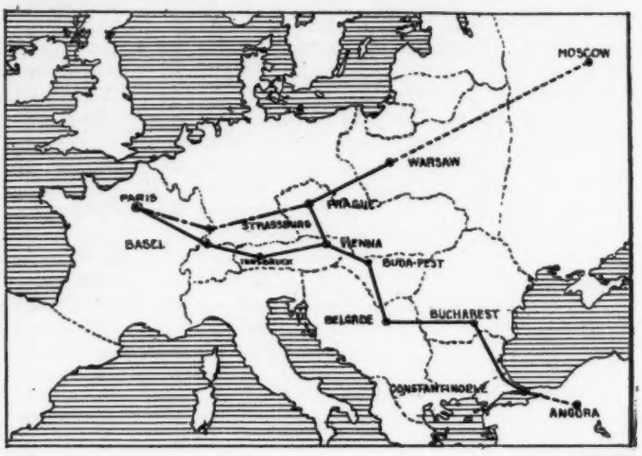
Total distance covered (km.)	*Distance covered daily (km.)*
1922— 899,000 (558,639 mi.)	1922—2,930 (1,821 mi.)
1923—1,239,000 (769,915 mi.)	1923—5,542 (3,455 mi.)
1924—1,260,000 (782,964 mi.)	1924—7,434 (4,613 mi.)
Freight carried (quintal-km.)	*Performance percentage*
1922— 781,000 (26,741 ton-mi.)	1922—89.0%
1923—1,847,000 (63,240 ton-mi.)	1923—94.8%
1924—2,080,000 (71,217 ton-mi.)	1924—96.0%

During 1924 the difficulties with Turkey were straightened out, the service to Constantinople was resumed, and a demonstration service from there to Angora, the present Turkish capital, was undertaken by the C.I.D.N.A. for three months. Meanwhile a German concern, the Junkers Airways, had also bid for the Angora extension. And now a truly Oriental interlude occurred. It appears that the French and the German company each worked different "leads" in the Turkish government and that each obtained definite promises that it would get the concession to carry mails, passengers and freight. When the rival firms finally discovered the true situation, the Turkish government elegantly extricated itself from any obligation by telling the two bidders to go ahead and run a competitive experimental service between Constantinople and Angora for three months, after which an award would be made on sheer merit. The Junkers Airways did not seem to relish this solution, for they withdrew from the scene, but the C.I.D.N.A. did as the government suggested. For three months its ships flew regularly between the old and the new capitals of Turkey, though the ground organization was chiefly notable for its absence. But when the trial period had elapsed, the C.I.D.N.A. still did not get the concession, for now the Turkish government made the award conditional upon the contractor installing an airplane factory with all the technical personnel required for producing airplanes of original designs.

New Organization

However unexpected this stipulation, which obviously favored the Junkers Airways because of their close connection with the Junkers airplane manufacturing company, the men back of the C.I.D.N.A.—financiers, steamship men and big traders—refused to be baffled. Instead they organized within a very short time a general aircraft agency to act as an intermediary between the French aircraft industry and the foreign aviation world. This agency will handle all questions pertaining to sales, publicity, demonstration of aircraft in foreign countries, organization of aircraft factories, supply of raw materials, etc. As the C.I.D.N.A. has agents in all the cities where its planes call, who are in close touch with local aeronautic affairs, it will be seen that this scheme starts under extremely favorable auspices.

The reason why the favors of the Turkish government are sought so strenuously by both the C.I.D.N.A. and the Junkers Airways is that the only commercially feasible air route from Europe to India, China and Japan, leads through Constantinople across Turkey and Mesopotamia. Owing to its various agreements with the countries of the Little Entente as well as with Austria, Hungary and Bulgaria, the C.I.D.N.A. is very strongly entrenched, politically and econonmically, on the route from Paris to Constantinople. For a long time the British air interests have attempted to shake this hold by proposing to establish an alternative route to the East, but nothing has come of these schemes and now it is announced that the C.I.D.N.A. and the Imperial Airways have come to a tentative agreement as to the future operation of the great Europe to Asia airway Under this plan the C.I.D.N.A. will run the service from Paris as far as Bagdad, while the Imperial Airways will operate from there on to India and Burma.



The C.I.D.N.A. Airways. The dash-dot routes over Germany have temporarily been abandoned. The dotted routes are for the future

The German air interests, which have been left out of this scheme, naturally try with all their skill to cut into the great Franco-British airways and get a share of the coming air borne trade before the best opportunities are gone. Turkey and Persia are the countries on which they concentrate all their effort at the present time. The Junkers Airways—whose activities can be said to extend over the entire "flyable" world—are now reported as organizing an airway through their Russian branch which will lead right across Persia, from the Caspian Sea to the Indian frontier.

K.L.M.

Last, but not least, the "K.L.M." or Royal Dutch Air Line, which is backed by important Dutch banking and exporting interests, is said to contemplate establishing an airway service between Holland and the Dutch East Indies, the possibility of which was brilliantly demonstrated by Van de Hoop's flight from Amsterdam to Batavia.

It will be seen from the above that a continuous air service from Europe to the Far East is nearing realization, even though present rivalries often seem to work at cross-purposes. That such a service will have to be essentially international in order to accomplish the best results for all concerned seems to be accepted by an ever growing number of students of the problem. How such a service can be made international and yet remain under the financial and technical control of the country which is primarily responsible for its organization is, on the other hand, a problem which baffles many a good mind. The Germans are fostering operating combines or unions of small national companies which are partly financed by German capital and are entirely equipped with German material, but which operate under their own national colors though in conjunction with the parent organization.

On the other hand the French system, as exemplified by the C.I.D.N.A., tends toward the creation of a strong national company in which the minority of the capital stock is held by nationals of the countries into which the company operates. From the viewpoint of the organizing company this system has the great advantage of giving it not only absolute control but unity of control as well—which the German operating combine lacks; but from the standpoint of the foreign minority stockholder it has the drawback of preventing the development of national air transport companies in the small, "collaborating" countries. The latter consideration is not merely one of nationalistic pride, for with the development of commercial air services their importance as reservoirs for war emergencies cannot help but grow.

In this connection it is of interest to note that when the

C.I.D.N.A. recently received an accretion of Czechoslovak capital—which determined the change of the company's name—the company had to guarantee employment to a given number of Czechoslovak pilots and mechanics. To make this clause operative, the French Parliament had to amend the air navigation law under which the entire flying personnel of French airway companies must be of French nationality. The amended text provides that a company drawing subsidies from a foreign country may employ nationals of the latter among its flying personnel. Whether this means that a Czechoslovak pilot may command a French aircraft remains to be seen. If so, it would indicate a departure from the marine practice incorporated in the International Air Convention under which the pilot in charge of an aircraft must be of the same nationality as the aircraft. It is possible, however, that the C.I.D.N.A. will surmount this difficulty by employing foreign pilots for test work only.

In the case of Czechoslovakia or Poland this question is really of secondary importance, for these countries are allies of France. With Russia, which is now negotiating with the C.I.D.N.A. for an extension of the Paris-Prague-Warsaw service to Moscow, the proposition would be more delicate, as may well be imagined

This year, for the first time, the C.I.D.N.A. will not fly over Germany, as under the peace treaty France can no longer claim the most favored nation treatment which was the legal basis of doing so up to the first of the year. Instead the services to Warsaw and Constantinople will be run via Bâle, Zurich and Innsbruck, as shown in the accompanying map, until the tangle of Franco-German air relations is straightened out.

French Cross-Country Meet

The Aero Club of Auvergne, France, is holding a national air meet on May 31 and has organized a rather novel form of On to X Race. The contestants are allowed to fly for six hours during the day but must arrive at the airdrome where the meet is to be held between 5:45 and 6:15 in the afternoon, if they arrive earlier they will not be able to cover so much distance and if they arrive later they are penalized or completely eliminated if they are more than 2 hr. 15 min. late. This will tend to bring all the contestants to the airdrome at about the same time which will make it much more interesting for the spectators. During the six hours allotted for flying, the contestants try to cover as much distance as possible. Some controlling official must witness the start and as many stops as desired can be made along the route. However if the pilot wishes to lengthen the distance which he flies by going on a zigzag course, instead of the greatest distance in a straight line, he must stop at designated control stations, so that the distance can be checked. The efficiency formula used is the square of the distance traveled during the six hours divided by the horsepower per passenger carried. This simple formula is supposed to make it possible for large and small planes to enter into the competition with their success depending on their efficiency. Flying the greatest distance during the six hours allowed puts a premium on the speed of the plane and living up to a schedule teaches the value of ground organization. There is a certain gambling element in choosing a point which will be favored by the wind as well as in laying out a course which can be covered in the assigned time and so avoiding a penalty.

National Balloon Race

As we go to press, it is reported that the Goodyear III piloted by W. T. Van Orman landed at Reform, Ala., approximately 600 mi. from St. Joseph, Mo., the starting point. All the other contestants have landed at shorter distances from the start.

International Newsreel Photo

Scenes during a recent aerial pageant at the Yoyogi Parade Ground, Tokio, under the auspices of the Kokumin Shimbun, a leading Tokio newspaper. The two amphibians in the upper right hand picture are a Supermarine and a Vickers

The New Packard Aircraft Engines

Detailed Description of the Latest Aircraft Engines Produced By the Packard Motor Car Co.

The new Packard aircraft engines are built in two sizes, the model 1500 rated at 500 b.hp., and the model 2500 rated at 800 b.hp. The engines are of almost identical design except in size and were developed concurrently to fill the demand for the entire range of water cooled engines as it exists today. These engines are suitable for power demands ranging from about 350 b.hp. to well over 800 b.hp., gearing being furnished when required to bring the propeller speed down to the point of maximum efficiency.

Externally the engines present an exceptionally clean appearance and are remarkably compact for their power output as shown by the superimposed views of the model 1500 and the Liberty engines in fig. 1. The relative power outputs of these latter two engines are shown in fig. 2 and a graphical weight comparison is shown alongside. From these diagrams it will be noted that the new small Packard engine is considerably lighter and more compact than the Liberty but develops far more power. The larger model 2500 engine is compared in fig. 3 in respect to power output and weight with its predecessor, the model 2025 engine, which powered the Verville-Packard plane, winner of the first Pulitzer race.

The compact construction, light weight and high power output of these new engines have been brought about by some rather basic advances in aircraft engine design resulting from the long experience of the Packard Motor Car Co. in designing and building airplane engines in quantities. In laying down the new designs the following fundamental principles were established.

(1). A very high degree of reliability must be attained.

(2). Greatly reduced weight and overall dimensions as compared with previous designs are highly desirable.

(3). The design must be simple, capable of production in large quantities and accessible for maintenance in the field.

Bearing Research

A comprehensive survey was first made of the fundamental factors in the design which would be most affected in carrying out these principles. It was found that the design of the crankshaft bearings would form the foundation of this research work as the length of the bearings would determine the length of the engine to a large extent. Accordingly, a series of bearing tests were run over a period of several months in order to ascertain the ideal combination of material, loads and sizes. As a result of this work it was found that if the bearings were made sufficiently rigid and a rapid circulation of oil was maintained through the bearings, in order to provide lubrication and carry away the heat generated, it would be possible to obtain satisfactory results with bearings far narrower than had hitherto been thought advisable.

For example, it was found out in endurance tests of these engines later that a bearing load factor as high as 35,000 lb. per sq. in. ft. per sec. yielded even better results from a standpoint of bearing life than previous aircraft engine bearings loaded only half as much but which were not as rigidly supported or as well lubricated.

While the compact overall dimensions of the new engines are basically determined by the new developments in bearing design, a contributory factor is the cylinder construction of these engines. The cylinders are individual and are of all steel construction, the six cylinders of a bank being formed into a block by means of an aluminum casting termed the valve housing to which the cylinders are bolted. The cylinder is composed of a drawn steel sleeve welded to a forged combustion chamber head which is machined all over and fitted with a head plate and sheet metal water jacket welded in place. Each cylinder is provided with four valves and short valve ports are formed integral with the cylinder. The valve ports are accurately hollow milled on their outer surfaces and the head plate is bored so as to form a pressed fit over the valve ports, the plate seating on shoulders so as to provide about 3/8 in. water space over the top of the combustion chamber.

The cylinder head is provided with five bosses into which long studs are screwed, thus supporting the valve housing. The spark plug bosses are formed integral with the combustion chamber. The weight of the complete model 1500 cylinder is 9.5 lb. and this cylinder develops nearly 50 hp. The weight of the complete model 2500 cylinder is 15.2 lb. and this cylinder develops nearly 70 hp. It will be noted that the cylinder hold-down flange is located some distance from the end of the cylinder barrel which permits of a very compact construction as the ends of the barrels of the two banks are practically allowed to touch inside the crankcase, the additional height of the crankcase due to this construction

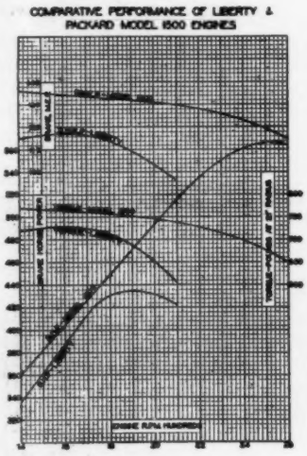


Fig. 2

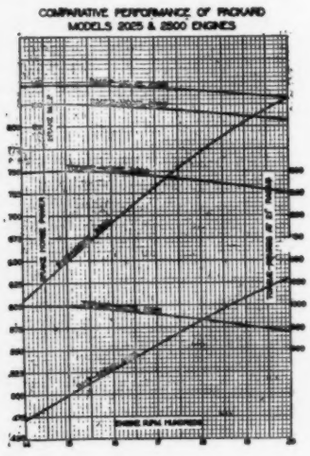


Fig. 3

naturally increasing its rigidity. Incidentally, it is the fact that the cylinder barrels project inside the crankcase which permits of these engines being run successfully in an inverted position, an arrangement now favored by many airplane designers.

Water is led into the individual cylinders from a manifold connected to short pipes welded to the jacket at the lower end and the water delivery from the cylinder is through a series of holes drilled in the top plate and arranged radially around the exhaust ports so as to insure against local steam pockets over the exhaust valve seats. A single copper-asbestos gasket is used between the individual cylinders and the valve housing, this gasket is, of course, not subjected to gas pressures as with the conventional automobile detachable head gasket but merely serves as a water seal and to prevent leaks between the inlet and exhaust passages.

The valve housing is an aluminum casting machined on all surfaces and used interchangeably on the right and left hand banks. The housing performs the following functions:

(1). Distributes the mixture to the six cylinders from the two carburetor cross header manifold connections.

(2) Forms the exhaust passages, each two adjacent cylinders having their two pairs of exhaust ports siamesed into a single exhaust outlet.

(3). Collects the water circulated through each cylinder jacket and delivers same through a single outlet at the front of the engine.

(4). Supports the camshaft bearing pedestals and valve stem guides.

Fig. 4 shows diagramatically the layout of the intake, exhaust and water passages in the valve housing and the unique

arrangement of four valves feeding from a common port will be noted. The advantages of this arrangement are that large and free passages are permitted and the casting is simplified due to the absence of intermediate walls.

A single camshaft is supported in seven cast duralumin bearings bolted to the top of the valve housing and this camshaft is provided with twelve cams, each cam operating a pair of valves through the medium of a cam follower working in a vertical guide formed integral with the camshaft bearings. These cam followers are prevented from turning by means of a flat milled surface on the side of the camshaft bearing. The cam followers are positively lubricated from the adjacent camshaft bearing and the exhaust cam followers are also utilized as pumps to force oil through the exhaust valves for cooling purposes. This feature of the design is shown diagrammatically in fig. 5 and the method of circulating the oil through the valves is described as follows.

Valve Cooling

The camshaft is hollow and supplied with oil under pressure through a continuous metering groove in the rear bearing. In the camshaft journal next to each exhaust cam a hole is drilled opposite to the nose of the corresponding exhaust cam and this hole registers with a vertical passage in the camshaft bearing pedestal when the cam is at its highest point and the exhaust valves consequently closed. The oil flows through this passage to the bottom of the cam follower guide which forms a closed end cylinder and the space underneath the cam follower is thus filled with oil. The camshaft in revolving cuts off communication with this passage and when the cam follower is depressed by the cam the oil can only escape by being forced through the hollow cam follower stem and the horizontal drilled passages leading out through the drilled tappets into the exhaust valve stems. The latter are drilled out their entire length, the lower end of the hole in the valve head being closed by a screwed-in plug. A small steel tube is welded to this plug and is centered in a counterbore at the upper end of the valve stem. The oil is forced down through the tube, out at the bottom through horizontal holes and thus cools the head of the valve. The oil is then discharged through the annular space between the tube and inner wall of the valve stem and out into the valve housing through horizontal holes drilled through the upper end of the valve stem just below the counterbore. With this system a fixed quantity of oil is pumped through each exhaust valve each time it is opened and thus a very positive means of cooling is provided. As a result the exhaust valves operate at a very low temperature and the valve seat is preserved in excellent operating condition over extensive periods.

Fig. 5

Valve Springs

Another feature worth mentioning in the valve gear is the valve spring construction. Instead of the conventional aircraft arrangement of double concentric valve springs a series of small diameter piano wire springs is arranged in planetary fashion around the valve stem guide. In the model 1500 engine there are seven of these springs to each valve, and in the model 2500 engine there are ten springs to each valve. The individual valve springs are located over tubular guides welded to a lower fixed washer and the upper ends of the springs engage in an annular groove formed in the movable spring washer.

This valve spring construction has been used for several years with perfect results on Packard marine racing engines which had heretofore given considerable trouble with valve spring breakage at extremely high speeds. The reason for this preferred construction is not due, as might be thought, to the extra factor or safety resulting from the use of a multiplicity of springs, but is due to the fact that in the small diameter springs the natural period of vibration is very much higher than in the conventional type of valve spring so that the destructive "dancing" of the valve springs is avoided with the small diameter springs.

A very light sheet aluminum cover is fastened to the valve housing and prevents external leakage of oil, this cover making a taper fit over the ignition distributor drive housings located at the center of the engine and described later. Oil from the valve housing is returned to the crankcase through

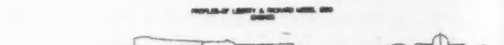


Fig. 1

liberal drains placed at both ends of the engine and provided with oil traps to prevent crankcase vapors accumulating in the valve gear compartment.

The crankcases on both engines are of the conventional box section type, the main bearings being supported in the seven transverse webs of the crankcase upper half. The crankcase finish surface, to which the oil pan is bolted, is brought down 2½ in and 2¾ in. on the models 1500 and 2500 engine respectively below the centerline of the crankshaft, the object being firstly, to add rigidity to the crankcase structure, secondly, to provide "ways" into which the main bearing caps are fitted, and thirdly, to render the oil pan attaching screws and nuts more accessible.

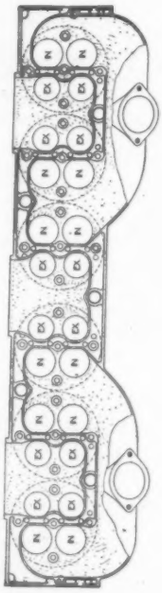


Fig. 4

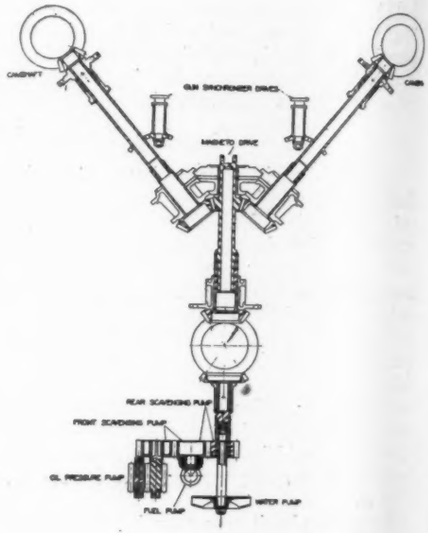


Fig. 6

The bearing caps are duralumin forgings except in the case of the front and rear caps which are cast of a special heat treated aluminum alloy. The main bearings are of babbitted steel-backed construction and are doweled to both the bearing caps and the crankcase upper half. The main bearings are provided with force feed lubrication, oil being delivered through a horizontal manifold pressed in the crankcase upper half and distributing through vertical tubes leading to each bearing pressed in the crankcase transverse walls.

The oil pan or crankcase lower half serves as a mounting for the combined water and oil pump unit and is provided with the scavenging oil line leading to the front end and serving to keep the crankcase scavenged on a glide. The oil

pan can be removed from the engine at any time without disturbing the engine bearings.

The crankshafts in both engines follow customary aircraft engine practice and are noteworthy for their rigidity, the main journals of the two engines measuring 3 in. and 3½ in. in diameter respectively, and the crankpins are 2½ in. and 3¼ in. in diameter respectively.

Both main journals and crankpins are bored out with large holes and the crankpins are plugged to provide an oil reservoir for leading oil to the crankpin journals. These reservoirs receive oil from the adjacent main bearings by means of steel tubes pressed into the crankshaft at an angle and lining up with the main bearing metering grooves at one end and the crankpin bore at the other. The main bearing metering grooves are located entirely in the upper half of the main bearings and extending the whole 180 deg. around their circumference.

The connecting rods of the model 1500 engine are of the forked and plain type fitted with Sumet bronze bearings, and the connecting rods of the model 2500 engine are of the articulated type fitted with babbitt bearings applied directly to the big end of the rod. The piston pin bushings in the connecting rods of both engines are of phosphor bronze and the same material is used in the link pin bushings of the larger engine. The link pins of the model 2500 engine are retained in place by a tapered draw bolt passing through a boss on the master rod.

The pistons of both engines are aluminum castings of the permanent mold type and are of the slipper type. They are noteworthy for being extremely short and comparatively light. The model 1500 piston is 5⅜ in. in diameter, 3 11/32 in. long and weighs 2.94 lb. for the bare piston. The model 2500 piston is 6⅜ in. in diameter, 3 15/16 in. long and weighs 4.47 lb. for the bare piston. The lengths of these new pistons were established after a series of tests were made in which the length of the skirt was gradually diminished.

The timing gear and accessory drive layout is shown in fig. 6 and is worthy of note firstly, for its simplicity, there being the minimum number of gears employed, secondly, for the integral construction of shaft and gear wherever permissible and thirdly, for the use of pressure lubricated chilled aluminum plain bearings throughout, these three features combining to save considerable weight while preserving dependability to the utmost extent.

The simplicity of drives was accomplished by grouping the accessories in a manner which effected important additional weight savings. All fuel, oil and water pumps were combined into a single unit which is used interchangeably on both the model 1500 and 2500 engines. This unit is driven through an Oldham coupling from a short shaft journaled in the rear bearing cap. This shaft carries an integral bevel gear at its upper end which meshes with a bevel gear mounted on an extension of the crankshaft.

The rear end view of the model 2500 engine shown in fig. 7 brings out the simplicity of the accessory drive layout as compared with previous types of aircraft engines, and the absence of engine accessories projecting to the rear of the engine will be appreciated by those having had maintenance experience with aircraft engines which have been installed in a crowded position against the firewall or front bulkhead of a plane.

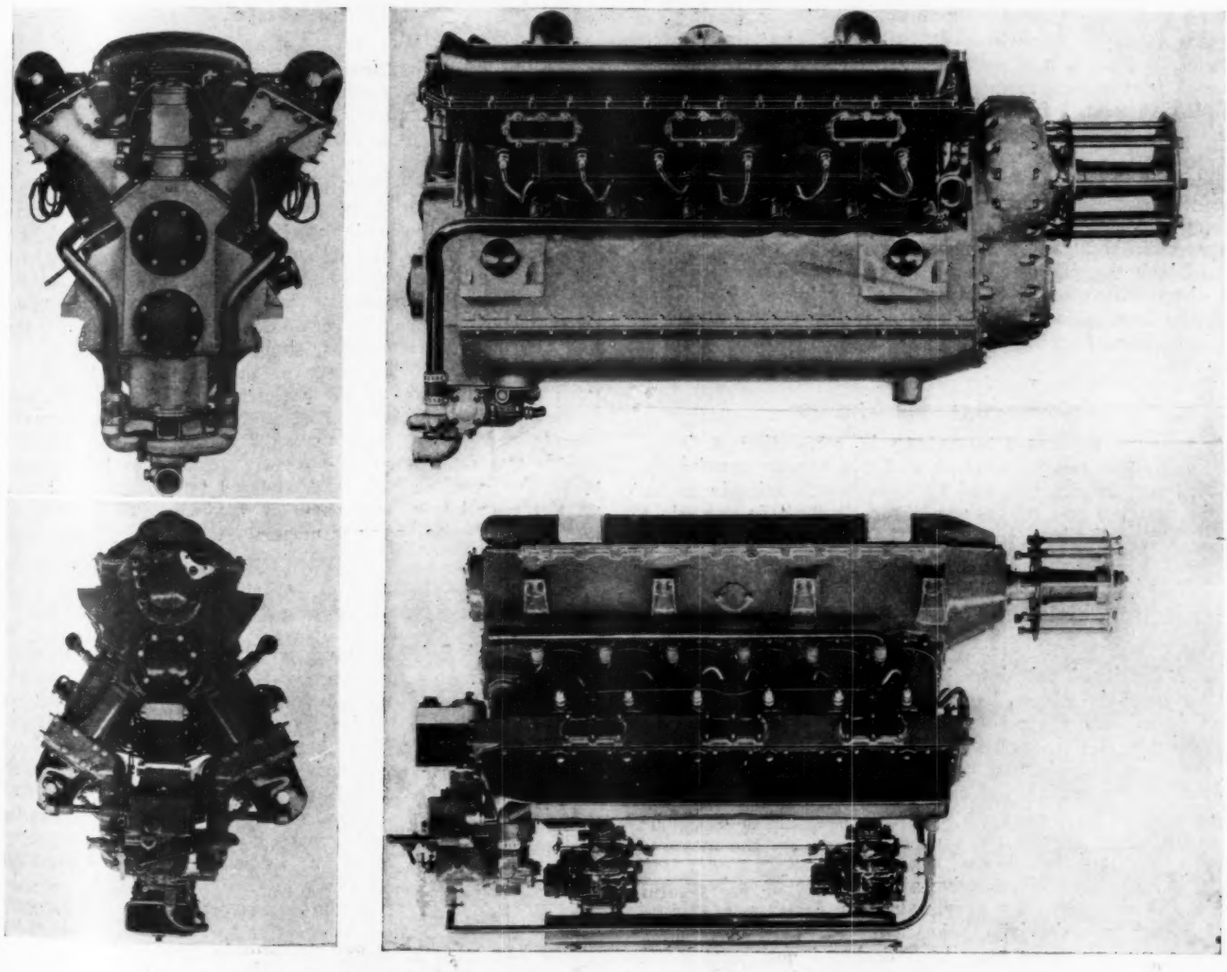


Fig. 7. Above: the 800 hp. geared model. Below: the 500 hp. inverted model

The pump unit contains three spur gears which are housed-in to form the two oil scavenging pumps and these gears in turn each drive another unit, the first driving the water pump,

the second the fuel pump and the third the oil pressure pump. The whole pump unit is quite compact and weighs only 16 lb. including in its assembly the oil strainer and oil pressure relief valve.

The camshaft center drive shaft is also formed with its gears integral and is continued through the top of the crankcase to drive the special magneto by means of a laminated spring coupling. This magneto is based on a principle invented by Packard engineers and developed by the Splitdorf Company and may be briefly described as a single mechanical instrument with all electrical parts duplicated and independent throughout. That is to say, there are only one set of magnets, one set of pole pieces, one rotor, one driving shaft, one coupling, one cam and one set of rotor bearings.

Electrical System

On the other hand, there are two primary and secondary coils, two condensers, two interrupter arms, and two sets of contacts as well as double external binding posts leading to the two separate distributors, either one of which will fire all twelve cylinders and each having its separate drive from one of the camshafts. The magneto employs but one magnetic circuit and the two electrical circuits are independent of one another throughout. The induction effect between the two primary windings is substantially eliminated through the use of an impedance coil in the switch to ground circuit. This instrument differs radically from the two-spark magneto used formerly to a considerable extent. In the older type it was customary to utilize both ends of the secondary winding, the high tension circuit being to one spark plug to ground and from ground back through the other spark plug. In this type of magneto practically any electrical failure resulted in both sets of sparks being simultaneously affected whereas in the new magneto the two electrical systems are completely isolated from one another and should one system fail it will not appreciably affect the operation of the other.

Timing of both the magneto and distributors has been facilitated in these new engines by specially developed mountings, the magneto being furnished with a slotted flange at the driving end, accurate timing being accomplished by swinging the magneto bodily on this mounting, two 5/16 in. nuts serving to lock the magneto in its desired position. Similarly, the distributors can be bodily rotated by loosening a clamp bolt, the final adjustment being made with the assistance of an inspection opening located over No. 1 left cylinder terminal.

Interchangeable Systems

A recently developed advantage in connection with this ignition system lies in the fact that a generator can be substituted for the magneto and by providing a suitable contact breaker on the end of the generator shaft, it is possible to secure battery ignition to replace the magneto ignition where desirable without any changes to the engine itself and with no changes to the wiring between the distributors and spark plugs, it being understood that the same distributors are used regardless of whether magneto or battery ignition is employed.

As a result of this interchangeable ignition arrangement engines used in planes having little electrical demands can be equipped with magnetos and those used in planes requiring considerable electric current, for wireless, lighting, etc., can be supplied with battery ignition. The result is that the weight of the engine for each service will be kept to the minimum and an engine can be transformed from one service to another very easily.

Although both the 500 and the 800 hp. engines were originally intended for direct drive service, both have been built for use with gears, the gear reduction forming a separate unit bolted to a special crankcase flange.

The gear reductions have been designed and built by the Allison Engineering Company of Indianapolis. They are of the spur gear single reduction type and are entirely self-contained. A noteworthy feature is the employment of a shock-absorbing drive between the crankshaft and the pinion that has proved very successful in eliminating the gear trouble resulting from impact loading. Fig. 7 shows a side view of the 800 hp. geared engine. These gear reductions give a two-to-one reduction to the propeller shaft that has been found to be particularly desirable for load-carrying airplanes of moderate speed.

In addition to providing improved propeller efficiency, these geared engines lend themselves particularly well to a streamline installation; and, in this manner, improved propeller efficiency and decreased resistance combine to offer important advantages in airplane performance.

The 500 hp. engine has also been built in the inverted type and, as mentioned previously, an inverted engine has many advantages for aircraft use. It is entirely possible that the future will see the inverted engine as one of the standard types. A side view and a rear end view of the inverted model 1500 engine is shown in fig. 7.

An inverted engine when used in airplanes, possesses four major advantages. First, in the usual type of single-engine tractor airplane, the pilot's vision straight ahead is seriously obscured by the cylinders and cowling of either a V-type or a large radial-type engine. He is practically compelled to swing the airplane from its true course to obtain a view along the normal line of flight. It is unthinkable that poor vision dead ahead, such as this, will be tolerated when the air is as full of airplanes as we expect it to be in the future. Collisions in the air, even today, are far more numerous than would be the case if poor visibility conditions did not exist. With an inverted engine, as shown in fig. 14, the cowling in front of the pilot can be made to slope to meet the line of the propeller hub spinner; in this way, favorable vision can be secured.

High Thrust Line

The second major advantage of the inverted engine lies in the high center of thrust that ensures better flying qualities, in that it offsets the tendency of the airplane to climb when full power is on. The additional propeller tip clearance is also desirable from a consideration of taxiing over rough ground and, in some cases, removes the limitation on the diameter of the propeller that would otherwise exist.

A third point in favor of the inverted engine is its accessibility to a mechanic working on the ground. If the engine mounting is properly designed and the cowling suitably arranged, the engine can be readily worked on from the ground without the necessity for stepladders and other equipment. Furthermore, the crankcase covers can be removed and the bearings examined, should this be desirable.

The fourth point in favor of the inverted engine has regard to the location of the carburetors that, in many installations, will allow gravity fuel feed and will avoid the use of complicated piping and pumping arrangements. The fire risk is also diminished to a certain extent with this arrangement, for gasoline leaks are confined to the extreme bottom of the installation, and covering the whole exterior of the engine with gasoline, as is normally the case, is not possible.

Farman Wins Solex Prize

The French Solex company which manufactures carburetors offered a prize of fifty thousand francs for the first man to fly from Paris to Rouen on less than 3 kg. of gasoline. The distance between these two points is approximately 100 km. and it was thought that there would be no competitors for the prize. However, Maurice Drouhin, a pilot for the Farman firm, decided to attempt the flight. The machine used was the Farman monoplane of the same type which won the light plane tour around France last year. The machine was fitted with a 3 cyl. 12/16 hp. Salmson motor. The flight was made on an extremely gusty day and according to the pilot was more of a proof of the maneuverability and flying qualities of the ship than of its gasoline consumption. Most of the flight was made at about 300 ft. but at times Drouhin took advantage of rising currents and was wafted up to 1000 ft. The time for the 100 km. was 1 hr. 20 min. and the gasoline consumption 2.923 kg. so that approximately 62 mi. was made to the gallon. This is considerably short of the records established at Lympne but none the less the flight was a noteworthy one considering the weather conditions.

Stability and Controllability of Airplanes

Part VI. Effect of Combined Roll and Yaw

By B. V. KORVIN-KROUKOVSKY

The action of the rudder is sufficiently simple and direct not to require much comment. The rudder controls the yaw and to this extent its action is similar to the action of rudders of seagoing vessels and in lighter-than-air craft. Contrary to these vessels, however, the yaw of the airplane does not necessarily produce a turn, which usually requires proper coordination of elevator, aileron and rudder controls. The behavior of an airplane under the action of rudder and resulting yaw depends largely on the degree of stability in roll it possesses, as we will show later.

As the elevators must be always considered in connection with their effect on the stabilizer, so the rudder must be considered together with its effect on the vertical fin. The total controlling effect of the fin-rudder surface, is obtained by virtually changing the camber, as well as the angle of incidence of such a surface, and is much more pronounced than the effect of an individual rudder for the same effort of the pilot. To obtain the best efficiency of the fin-rudder combination, the rudder must form the trailing edge of the fin and must not project beyond its tip. Rudders with overhanging or *horn* balance projecting above the fins were extensively used, but the modern tendency, as demonstrated by the Douglas World Cruiser and the latest competition of Army CO ships, is to eliminate these overhangs. In ordinary cases the effort required to operate the rudder is not large, and does not justify balancing it. The overhanging balances were often provided in the past just as a means of increasing the rudder area, and supposedly its effectiveness, as designers always seem to experience difficulty in the location and arrangement of the proper amount of fin-rudder area. It must be borne in mind, however, that a small additional area of the rudder placed behind the small area of the fin always will give larger controlling effect than an overhang of the rudder of the same total area. It is difficult to state the best proportion of rudder area to total vertical empennage area, as the rudder usually gives the least amount of trouble of all controlling surfaces, and great variation of its proportions are found in practice. The rudder is usually hinged partly to the fin and partly to the fuselage. If the latter has sufficiently fair shape, and is gradually narrowed toward the thickness of the rudder, as it should, it must be considered also as fin area. We would recommend that instead of areas, *the chords of the fin and rudder be considered, and the chord of the fin is made from 1½ to 2 times the chord of the adjoining rudder.* In the case of an outrigger tail or a fuselage with a horizontal knife edge stern, this rule will make the rudder area equal to 30 or 40 per cent of the total empennage area. In the case of the airplane with a very deep fuselage, the latter will replace part of the fin, and the rudder area will form a larger percentage of the vertical empennage area, probably not over one half of it. In justification of the rule proposed above we will call the reader's attention to Fig. 14, showing the arrangement of the vertical tail surfaces on six distinctly successful airplanes, of which last four are praticularly noted for their maneuverability. The percentage of rudder to total empennage area as marked in Fig. 14 is estimated from drawings and photographs published in different periodicals, but is sufficiently accurate to illustrate the trend of good designs.

It is a matter of practical observation that every movement of the airplane in yaw makes it roll, and every roll has an effect on the yaw. The interrelation between the yaw and the roll of an airplane is the most important factor in the study of lateral stability as a whole. It is not the roll or yaw alone that we feel in the control of an airplane, but the combined effect of both.

The very fact of the roll of an airplane has no influence on the yaw, but the roll and resulting bank cause a side slip in response to which the airplane yaws. We determined the stability in yaw as the tendency of an airplane to head into the relative wind. Therefore, if an airplane, very stable in yaw, begins to roll and consequently side slip, it will turn in the direction of the side slip. In other words, it will tend to transform any side slip into a correct turn. If the airplane is neutral in regard to stability in yaw it will not react to roll at all. Such an airplane can side slip until corrected by the stability in roll, still retaining its original orientation. Thus we see that *an airplane nearly neutral with respect to stability in yaw will preserve its direction better than an airplane very stable in yaw.* If the airplane is unstable in yaw it will turn its tail in the direction of side slip, thus aggravating it, and eventually will cause a loss of forward velocity and a tail spin.

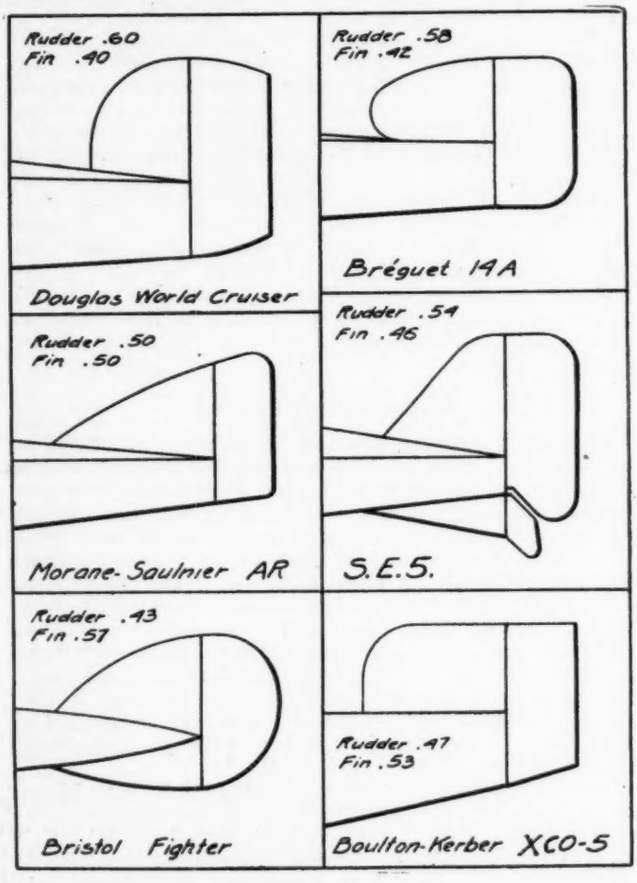


Fig. 14

The yaw affects the roll in two ways. The first and immediate effect of the yaw is to move one wing forward and the other one backward. This causes an increase of air speed and consequently an increase of lift of the wing moved forward, and a decrease of the air speed and lift of the wing moved backward. The evident result is a drop of the wing moved backward, or a roll of the airplane in the direction of the yaw: yaw to the left makes an airplane roll to the left. This effect, being based entirely on the change of the air speed of the two wings, is equally effective above and below the stalling angle, and in fact is the only means of lateral control after stall. The response of the airplane to yaw in this respect is directly proportional to square of the span, and is inversely proportional to the air speed. Indeed if the angular velocity of yaw is such as to move one wing forward with velocity of 2 ft./sec., while the airplane is flying at the rate of 100 ft./sec., the gain in lift is $(102/100)^2$ or 4 per

cent. If on the other hand the airplane is flying at 50 ft./sec., the gain in lift will be $(52/50)^2$ or about 8 per cent. When one considers the fact that the damping in yaw decreases with the speed, and quicker yawing can thus be affected, the value of the rudder for maintaining lateral stability at very low air speeds can be readily appreciated.

For convenience we will refer hereafter to the effect described above, the effect of angular velocity of yaw on the roll, as the *"first effect"* of yaw, as distinguished from *"second effect,"* resulting from the fact that the airplane *is* yawed. These are by no means accepted terms, and are used here only for brevity in the following discussion of airplane behavior.

The *Second Effect* comes from the fact that when the airplane is yawed, its stability in roll tends to adapt itself to the yaw, as we showed it while discussing the elements of stability in roll. The airplane stable in roll will tend to raise the wing on the side of the relative wind, and consequently will transform the yaw into the correct turn in the same direction. In this case both effects of the yaw act in the same direction and invariably make the airplane assume bank and eliminate the yaw. Such an airplane can be steered evidently by the rudder alone without the use of the ailerons.

The airplane neutral with respect to stability in roll will not respond to it, and may skid or side slip indefinitely. In this case there will be no *second effect* of the yaw, and such rudder effect on the roll as may be found will be derived entirely from the *first effect,* that of angular velocity of yaw. To obtain the benefit of the *first effect* in practice quick movement of rudder is usually required, causing quick yaw and therefore large difference in velocity of two wing tips.

An airplane unstable in roll will bank in the opposite direction, i.e. will drop the wing on the side of the yaw. The side slip resulting from such a bank will be added to the relative wind due to yaw, and will cause the airplane to roll still more, and so on until it will capsize. It is evident that in this case the rudder cannot be used for control of the roll to any extent.

Model Demonstration

The idea of combined action of the stability in yaw and in roll can be obtained best by studying the behavior of the elementary models shown in Fig. 15. Such models were constructed by Bairstow, and were used by him for popular demonstration and explanation of lateral stability and instability of airplanes as derived from his mathematical reasoning. Sketch A shows a model consisting of one flat sheet of mica loaded at the leading edge, without any dihedral, stabilizer or vertical fins. This model is practically neutral in regard to stability in either roll or yaw, only a very slight degree of stability is derived from the movement of the center of pressure. If launched in a favorable condition it may achieve fair glide, but if disturbed in any way or launched at some angle of bank it will side slip to the ground without showing any tendency to right itself.

Sketch B shows the model obtained from A by the addition of an empennage, particularly a large vertical fin. The model is very stable in yaw and is almost neutral in roll. This model starts a fair glide, but has a pronounced tendency to start the turn and to tighten it steadily into a steep spiral. Any disturbance in roll, however slight, causes side slip, and the stability in yaw makes the model head in the direction of the relative wind. The angular velocity of this turn makes the outer wing move faster than the inner one and thus increases its lift and consequently adds to the roll. In this case initial roll causes yaw, and the yaw aggravates roll. This type of instability, quite common in actual airplanes, is know as *Spiral Instability.* We call particular attention of the reader to the fact that it is the predominance of stability in yaw over stability in roll that causes the trouble, and that increase of stability in yaw by increasing the size of the fin will aggravate the spiral instability. The only remedy is to increase the stability in roll, by the addition of dihedral or a vertical keel over the center of gravity. The spiral instability vanishes when the stability in roll generates a restoring rolling moment quicker than the yaw (*first effect*) generates an upsetting rolling moment in response to the side slip.

Sketch C shows the model made unstable in yaw by the addition of a large fin surface forward of the center of gravity and by reducing the size of the empennage. When launched this model flies straight for a few feet then suddenly starts a quick yawing motion, which immediately causes it to bank in the direction of the turn, as well as to lose its forward velocity, with the result that a typical tail spin developes. This case is known as *Spin Instability.* The intermediate case between B and C is obtained by fitting large fins fore and aft, so as to obtain fair stability in roll and moderate instability in yaw. If such a model is yawed by some accidental disturbance, say to the *left,* its stability in roll will make it roll to the left while instability in yaw will increase the yaw in the same direction. This results in a rather sharp turn, the model overbanks and begins to side slip to the left, which reverses the direction of moments and starts yaw and roll to the *right.* In a short time the model regains its position on an even keel again, but is still yawing to the *right,* what results is a repetition of the cycle in the opposite direction. The model displays in flight severe rolling and yawing oscillations, usually increasing in amplitude.

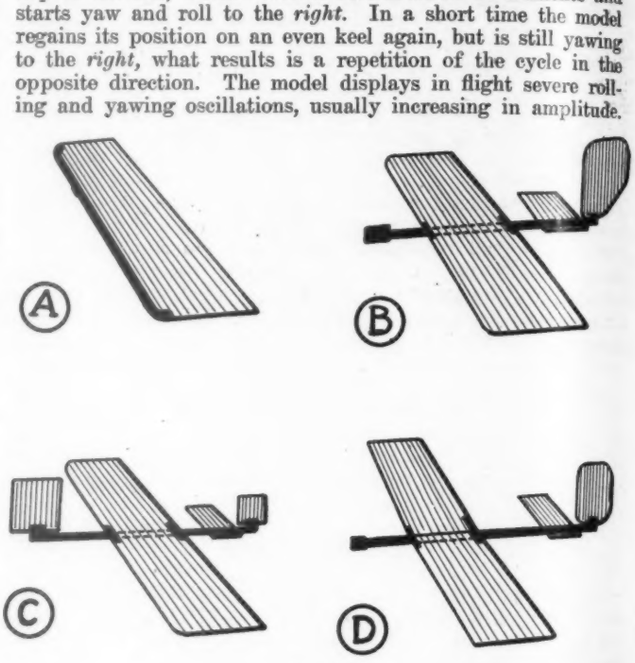


Fig. 15

Sketch D shows the model made stable in roll by dihedral of the wings and in yaw by the addition of vertical empennage, the stability in roll predominating over the stability in yaw. This model rights itself and assumes a glide on a straight line, no matter in what attitude it is thrown into the air. If launched from some height with wings in vertical position and fuselage horizontal, it immediately begins to roll to gain horizontal position of the wings, yawing at the same time head in the direction of motion. A glide on a straight line is invariably resumed, but the direction of original motion is not preserved.

The stable model, or airplane for that matter, has a tendency to travel in a straight line, but has no preference as to the point of the compass, and probably will change its direction of motion after each notable disturbance. The disturbance in the direction of travel results essentially from the stability in yaw, and will be least when the airplane is neutral in this respect, i.e. when any disturbance in roll is corrected by the stability in roll alone, without affecting the yaw.

In closing this chapter we will emphasize that insufficient vertical empennage results in *spin instability* in the case of airplanes neutral in roll, and in *unstable oscillations* in the case of airplanes stable in roll. A certain area of the vertical empennage will produce a stable model or airplane, while a further increase of the empennage area results in *Spiral Instability.* If the stability in roll is low, the allowable variation of empennage area is extremely small, and slight change of it may result in *spin* or *spiral* instability. As the stability in roll is increased, the airplane becomes much less sensitive to the variation of empennage area, and large changes can be made without danger of producing lateral instability.

(To be continued)

How the War Department Retards Flying

The War Department in asking further appropriations for aviation claims that it is fostering commercial aviation. Recently, drastic orders have been issued regarding the use of government flying field facilities by private aircraft. It should be remembered that protests have recently been made regarding the competition of the government with private aircraft operations and it is possble that these regulations are one of the results of these objections. The War Department follows.

"It is the policy of the War Department that owners of private aircraft should not be permitted to use any active Government airdrome as a base. The use of such airdrome by operators of private aircraft may, however, be permitted, in the discretion of the commanding officer of the station, upon condition that the aircraft is not operated for profit, that it is housed in privately owned hangars not located on Government property, and that assistance will not be required from the personnel of the station as to maintenance, repair, or operation.

"In the case of Government-owned airdromes announced from time to time as being on an inactive status, operators of private and commercial aircraft may be permitted, when airdrome facilities are available, to use such facilities, subject however, in each case to the approval of the War Department and under such regulations as are now or may hereafter be prescribed.

"With regard to airdromes leased by the Government, owners of private and commercial aircraft may obtain permits from the lessor to use the facilities at such airdromes under the rules and regulations that apply to the use of the airdromes by Army organizations. In all cases, however, this permit must have the approval of the War Department.

Bond Required

"All persons before obtaining permission to use airdrome facilities as contemplated in paragraph 1, 2 and 3 above, must furnish a bond for $5,000 to protect the Government against damage to property.

"Nothing herein contained shall be construed so as to deny privately owned aircraft the privilege of landing on Government landing fields in emergencies endangering life or aircraft.

"Owners and operators of aircraft making use of facilities at Government stations under the foregoing authority (pars. 1, 2, 3, and 5) do so at their own risk and, in addition to complying with existing regulations of the War Department, will be advised of and required to conform to all local rules and regulations."

The DeHaviland Moth

The latest production of the DeHaviland Aircraft Co. of England is the Moth (DH60) private plane. This machine is a normal tractor biplane, closely resembling in general outline, the DH9 of the same designer. It is intended to be used for training and private use and is powered with the 60 hp. Cirrus engine described on page 353 of the March 30 issue. Pilot and one passenger are accommodated in two cockpits, both of which are fitted with controls. The joystick in the front cockpit can be removed and an aluminum cover is provided to fill in the resulting gap in the floor.

This machine is not a light plane in the true sense of the term but it is designed to be used as the advocates of the light plane postulate; that is, for training, for flying club equipment and for private use. While the same performance will some day be achieved with a true light plane engine this plane is available today and should find ready welcome.

The cellule is a single bay biplane with no sweepback and a three and a half degree dihedral angle on both upper and lower wings. The wings fold back making the overall span when folded that of the tailplane. A false, metal strut is provided to support the inner leading edge. It is claimed that the wings can be folded back or rigged for flight by one man in three minutes. The empennage is quite conventional. Ailerons are fitted to the lower wing only.

The engine is mounted directly on the top longerons which are strengthened at this point for that purpose. The carburetor projects outside the cowling giving security against fire. A metal shield prevents undue cooling of the carburetor. The fuel tank is in the form of a thickened wing section and forms the center section. It holds 18 gal. and is divided into two portions, a main and a reserve. This gives the machine an endurance at cruising speed of 3½ hr. A hand starter is provided in the rear cockpit.

CHARACTERISTICS

Span, upper and lower	29 ft. 0 in.
Chord, upper and lower	4 ft. 3 in.
Gap	4 ft. 10 in.
Length overall	23 ft. 5½ in.
Height overall	8 ft. 7 in.
Span of tail	9 ft. 8 in.
Chord of tailplane	2 ft. 4 in.
Chord of elevators	1 ft. 10 in.
Span of rudder	4 ft. 5½ in.
Chord of rudder	2 ft. 4½ in.
Track of wheels	4 ft. 4 in.
Incidence	3.5 deg.
Dihedral	3.5 deg.
Ground angle	11.25 deg.
Area of wings	229. sq. ft.
Area of ailerons	22 sq. ft.
Area of tailplane	11.5 sq. ft.
Area of elevators	12.25 sq. ft.
Area of fin	3.12 sq. ft.
Area of rudder	9.0 sq. ft.
Weight empty	764 lb.
Weight loaded	1,250 lb.
Wing loading	5.46 lb./sq. ft.
Power loading	20.83 lb./hp.
Maximum speed	90 mi./hr.
Landing speed	40 mi./hr.

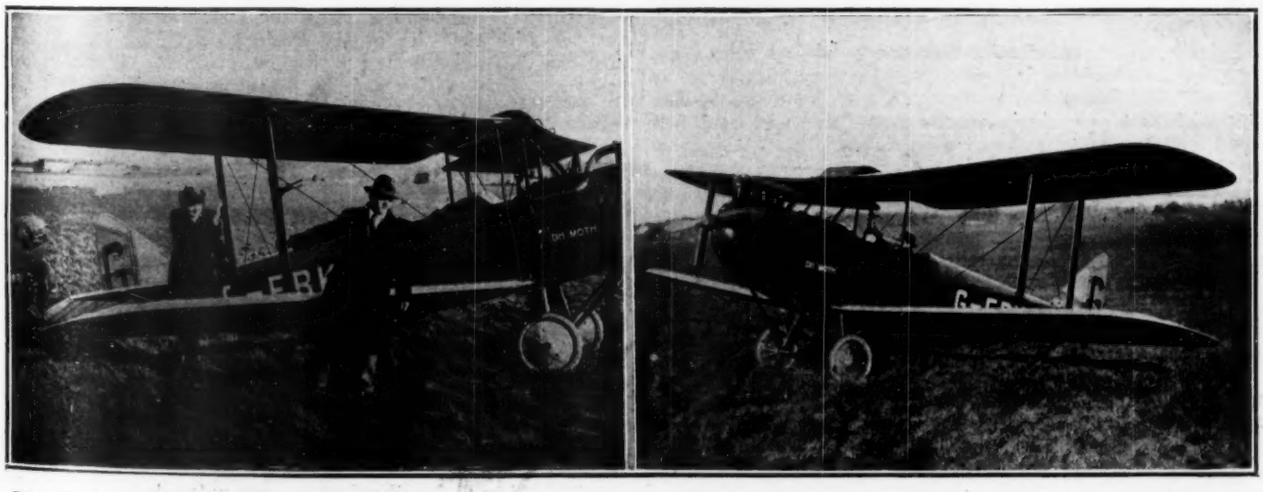


Photo Kadel and Herbert — Photo P. & A.

Unfolding the wings of the DeHaviland Moth (DH60) and ready for flight

AIRPORTS AND AIRWAYS

Cincinnati News

By Ralph Love

Maj. E. L. Hoffman, commanding officer at the Grisard Field, sailed on the Olympic last week for a three months' vacation in Europe. During the absence of Hoffman, Capt. Frank H. Pritchard, Dayton officer, will be in command.

Lieut. Wright Vermilyea, in charge of construction on the new Lunken Field, located in the river bottom near Cincinnati, is rushing work on the new government field so that the opening will be made in the early fall. $43,000 is being spent on the new field in construction work, hangars and modern aviation equipment.

The first forced landing ever made in an Ohio river was made April 19 by Lieut. Dudley Miller Outcalt and Capt. John Pattison. While flying over the Ohio River, at an altitude of 500 ft., the engine went dead. Outcalt, piloting the ship, had to choose between landing in thick brush near the river, or the water. He chose the latter and suffered no mishap. A motor boat towed the plane to shore where it was disassembled and carried to Grisard Field.

Air mail service between Cincinnati and Cleveland probably will be innovated this summer. Hugh Watson, crack commercial flier, conferred with Postmaster Arthur L. Behymer last week and the latter expressed himself in favor of night service between the two cities. Watson is making efforts to have the cities between Cincinnati and Cleveland erect beacon lights to guide him, in the event his bid is accepted.

Seven new passenger ships, built especially for passenger service, are being assembled by the Watson Airport Co. for inter-city flights. Hugh Watson, president of the airport company, plans on excellent service between Cincinnati and distant cities, to start immediately after the planes have been tested.

The Pavey Flying Co. will conduct an instruction school this year, according to Wendell Pavey, Cincinnati Ford dealer, who is in charge of the field. Pavey says that in addition to passenger pleasure flying, he is going to have an instruction school as well as regular air advertising service.

Detroit, Mich.

By Virgil Simmons

The "Maiden Dearborn," the second Air-Pullman turned out by the Stout Metal Airplane Co., is now making a daily round trip between Detroit and Chicago, carrying Ford freight and mail. This ship does not have the dual Dep control, as the "Maiden Detroit" had, but is equipped with a single pilot's seat, with a single set of controls, placed immediately behind the engine.

Detroit realtors are finding that the consistent use of aircraft in their business is productive of a very high factor of success. The Burns Fliers, who have moved here from Fenton, Mich., are operating from the Seven Mile and Southfield Road aviation fields, and are using many different types of airplanes in this work.

Eddie Stinson has secured the former Michigan Fliers Field, on Southfield Road, for the season and plans to use his Junkers, Liberty 6 Standards, and JN's for inter-city transport, short flights and student instruction.

A large class of students has been enrolled both by Overcashier and the Wolverine Fliers, the former is operating from his Monier Road Field and adjacent fields, the latter from the large John R and 16 Mile Field.

While it is true there has been a tremendous decrease in aerial activities, extending over a period of about two years, at Packard Field, this year should see a decided boost to all phases of commercial flying, at this advantageously situated airport.

It has been the writer's privilege to secure the Eastwood Field and all improvements and flying equipment from John Salter, owner of the property, and R. L. Francis, president, Central Oil Co., who operated the field, commercially last season. It is planned to put a number of new 3, 4 and 5 place ships on this field at an early date to accommodate the large week-end demand for flights.

The John R and 16 Mile Road Field, comprising 200 acres, has been leased by the Simmons-Taylor Airplane Co. for the season. It is planned to have an "Aviation Day" at this field soon, with open house to everybody, especially those who come by air, and with the kind assistance of the First Pursuit Group, it is hoped to provide an occasion that will be as long and comparatively well remembered as the 1920, Naval Air Station, San Diego, Hallowe'en Party has been.

Philadelphia, Pa.

The message which Capt. Victor Dallin, a Philadelphia aviator, carried on a flight commemorative of Paul Revere's ride, was delivered on the afternoon of April 15 to Mayor Kendrick at the City Hall. The message was one of greetings and felicitation and wishes for the success of the Sesquicentennial celebration and was signed by Mayor James M. Curley of Boston. Captain Dallin, owing to the absence of a flying field in this city, landed at the Pine Valley Field in New Jersey below Camden, and came to the city at night April 14. Mayor Kendrick received him at 1:30 p. m. April 15.

In a New Swallow, Captain Dallin made the flight from the Boston municipal airport in 3 hr. 15 min. He received the message from Mayor Curley in front of the Boston municipal building and hastened by auto to the airport, starting his flight at 3 p. m.

The message from Mayor Curley to Mayor Kendrick read:

To The Mayor of Philadelphia, Pennsylvania
From The Mayor of Boston, Massachusetts

Patriots Day, 1925

Greeting:

On this, the 150th anniversary of the Battle of Concord and Lexington and the initiation of the historic events that led to the establishment of American Independence and the organization of the United States, on behalf of the City of Boston, intimately associated with the days and deeds of that glorious epoch, I send you greetings and the sincere wish that the contemplated celebration of the 150th anniversary of the Declaration of Independence, in the year 1926, by the City of Philadelphia, where the immortal document was prepared and promulgated, may be marked by the success, acclaim and honor its significance and importance demand.

The City of Boston holds out the hand of fellowship to the City of Philadelphia, with the assurance that it is still as one with the City of the Declaration on all that makes for the glory and honor of the Republic, the integrity and security of the Nation and the peace, prosperity, contentment and happiness of the American people.

JAMES M. CURLEY

Monmouth, Ill.

The Air Mail field at Monmouth is now in full operation. The first ship was flown there from Chicago by Harry G. Smith, the superintendent. This was the Curtiss Carrier Pigeon and it arrived late in the afternoon of April 20. It is expected that the Aerial Mercury and the Elias M1 will arrive at the field shortly. It is reported that these machines and any others that the Post Office Department may accept will be put through their final tests here.

Prof. E. P. Warner of M.I.T. has visited the field several times and he is expected to be a frequent visitor during the summer. Frank Burnside, Air Mail test pilot, had the Carrier Pigeon up for an hour on April 28 to familiarize himself with the machine. On the twenty-ninth he flew it to Maywood Field, Chicago, for the first cross-country test. George J. Wurtz of the Curtiss company is also at the field assisting in the tests.

B. Russell Shaw

Ford Organization

Maj. R. W. Schroeder, vice president of the National Aeronautic Association, and former holder of the World Altitude Record, and B. Russell Shaw for three years executive vice chairman of the Contest Committee of the National Aeronautic Association, on May 15 will take up their duties with the new commercial Ford Airlines and the Stout Metal Airplane Co. of Detroit, Mich. Major Schroeder will be superintendent of Flying Operations while Mr. Shaw will be placed in charge of ground organization.

Major Schroeder's experience in aeronautics fits him admirably for this work. Major Schroeder learned to fly in 1910 and served as mechanician and assistant pilot with some of the best exhibition fliers in the country until our entry into the war. During the war and for some time afterward, he was chief test pilot at McCook Field. While at McCook Field he made many notable flights, among them the one man and the two man altitude records. He was the United States pilot in the 1920 Gordon Bennett race in France. He left the service in 1920 and became the aviation engineer with the Underwriters Laboratories.

Mr. Shaw who is one of the pioneer constructors and aviators in the United States has probably had as much experience in this line of work as any other man connected with American aeronautics. He began his study of aeronautics in 1908, constructed his own machine and taught himself to fly and was for two years the youngest aviator in the world. Mr. Shaw two years before the War, was connected with the Wright Brothers of Dayton, Ohio, was assistant director of flying at McCook Field during the War, and in later years he has been in charge of the International Races.

Rudolph W. Schroeder

New Haven, Conn.

A new concern has been incorporated under the name of the New Haven Air Terminal. The property secured is that of Mary W. Allen and extends from Woodward avenue to the harbor front.

The purpose of the company is to develop the property into a modern aviation field and seaplane base to meet the demands of the commercial air activities that have started to grow in this country.

This spot is an ideal one for the commercial machine, as it is within fifteen minutes of the heart of the city. It affords an unobstructed approach in every direction for both land and water machines and there is plenty of room for its expansion when the need arises.

The spot secured is an ideal one for New Haven. It affords space for both seaplanes and land planes. The company is composed of local men who have a good knowledge of aviation. They will develop things at a moderate pace and with the idea of giving the New Haven people the best aviation service possible.

The seaplane base will be developed first after which work will start on the field. On March 25 the workmen started erecting on the shore front a modern seaplane hangar from which will extend into the water a large wooden runway. Gasoline and oil tanks have already been installed. Orders have been placed for one large passenger flying boat, and one small express boat, one school and one photographic machine. These will be put into service for passenger and express work to all points. If there is enough demand passenger machines on schedules will run between New Haven and other cities. An aviation school will be conducted with J. Tweed as instructor. An aerial mapping and photographing service will be available to anyone needing this type of work.

Pascagoula, Miss.

By J. D. Crane

There is a very good landing field at Pascagoula. Although there are no hangars or accommodations, the field is only about three quarters of a mile from the city square. Good Gulf or Standard gas can be obtained at the field by telephoning. The field is owned by the county and can be used by anyone who wishes to do so.

The Navy training school at Pensacola, Fla., uses the field quite often and several private planes have found it a very convenient stopping place.

Deruluft Statistics

The Deruluft (Deutsch-Russische Luftverkers Gie.) has been operating the line Konigsberg-Kovno-Smolensk-Moscow for the last three years. The following table gives the main data on this airway:

	1922	*1923*	*1924*
Passengers	286	352	522
Mail	1,047 kg. (2,309 lb.)	1,648 kg. (3,633 lb.)	2,388 kg. (5,225 lb.)
Freight	**18,298 kg.** (40,344 lb.)	**22,468 kg.** (49,533 lb.)	**34,454 kg.** (72,038 lb.)
Trips	113	155	285
Distance	134,800 km. **(77,549 mi.)**	192,680 km. (118,727 mi.)	334,000 km. (207,536 mi.)

Many of the passengers on this airway fly regularly and they are nicknamed "Luftonkel" (Air-uncle). Some are reported to have made from thirty to sixty trips. The principal business of this line is carrying the couriers and mail of the Soviet and, is in consequence, subsidized. However, the average load per trip in 1924 was 1.84 passengers, 18.4 lb. of mail and 253 lb. of freight and average trip, 728 mi., roughly the distance from New York to Chicago.

Essington, Pa.

Pilot Jack H. Tweed of New Haven has purchased two new MF boats from the Essington School of Aviation. Henry Schiebel of New York also bought a new boat for his use at Mt. Vernon, N. Y. The Cleveland Aeroplane Co. bought two of the 39B seaplanes for their school. Arthur Brock of Philadelphia bought a 39B to use in connection with his other planes for aerial mapping.

Several students are due for training and the demand for planes has been greater this year than ever before.

Danish Air Services Consolidated

The Danish Government has arranged a merger of the two air transport companies of that country, the Danske Luftfartselskab A. S., and a new company recently formed with the aid of German airplane manufacturing interests reports Commercial Attaché H. Sorensen, Copenhagen. The consolidated company is to be known as the Danske Luftfartselskab, with a capital of 500,000 crowns ($90,000 at rate of April 1). The company will receive a four years' State subvention of 250,000 crowns ($45,000). As a result of the consolidation, it is expected that a definite program for contact with other Scandinavian and European air lines will be realized.

UNITED STATES AIR FORCES

U. S. ARMY AIR SERVICE

Philippine Maneuvers

During the recent maneuvers of the Philippine Division, between Fort William McKinley and Manila, the Air Service played an important part. This is one of the first instances where a whole group consisting of observation, pursuit, and bombardment participated in maneuvers carried out on so large a scale. An Air Service Radio truck was stationed near Brigade Headquarters at which point, Lieut. E. G. Harper performed the duties of Air Service Liaison Officer and relayed requests for service to the base at Camp Nichols. The photographic work was very interesting and quite instructive. The entire sector of operations was photographed. Many photographs were made of positions held by friendly troops and rushed back to Headquarters. In short, the airplane proved itself very efficient in keeping the General in command intimately acquainted with the doings of his own units. Radio, Very pistols, smoke signals, message bags, and panels of all kinds were used as means of communication between planes and ground.

Bombing attacks were simulated upon bridges across the Pasig River and other strategic points. The most spectacular Air Service activity was that of an attack made by the Third Pursuit Squadron upon an anti-aircraft battery. At the time of the bombing attacks upon the bridges the pursuit endeavored to occupy the attention of the recently discovered anti-aircraft batteries. A "V" formation of MB3A airplanes circled high over head, then dropped in column formation. Sneaking down behind the woods near the anti-aircraft guns, the MB3A's gathered speed and with a final long dive headed straight for the guns' positions coming so close as to actually throw a chill into the gunners. Again and again the battery was attacked until the bombers had done their work. The officers at Fort McKinley seemed very pleased with the cooperation of the Air Service.

Boles Field

While on detached service at the Kilauea Military Camp on the Island of Hawaii near the famous Kilauea volcano, the 72nd Bombardment Squadron of Luke Field, H. T., after ten days of recreation, turned to and cleared a landing field on a bluff overlooking the great crater, to be used in place of the old field which was destroyed during the eruption of May, 1924. The new field bears the name of "Boles Field," out of compliment to John Boles, superintendent of the Hawaii National Park, of which the Kilauea volcano is a part, and through whose efforts the new airport was set aside from the public domain for military use.

Fifth Composite Group

During the month of March the 5th Composite Group, Air Service, stationed in Hawaii, flew a total of 545 hr., which includes some 48,485 man miles of inter-island cross country flights.

Army Air Orders

First Lieut. John Y. Yorke, jr., A.S., Brooks Field, to Kelly Field.

Resignation by Sec. Lieut. Oscar Carlton Stewart, A.S., accepted.

First Lieut. Richard T. Bennison, A.S., (Field Art.), Kelly Field, to Fort Bragg.

Sec. Lieut. John Carter Holliday, A.S. Res., Washington, Pa., to active duty, Washington, D. C., reverting to inactive status June 29.

First Lieut. Arthur B. Custis, A.S., Brooks Field, to Kelly Field.

Appointment of Lieut. Col. James Edmond Fechet, A.S., to Assistant Chief A. S., with rank of brigadier general, announced.

International Newsreel Photo

Generals Fechet and Mitchell. The new and old Ass't. Chiefs of Air Service

U. S. NAVAL AVIATION

New Endurance Record

The Naval flying boat PN9 made a new endurance record of 28 hr. 36 min. May 1 and 2. She was piloted by Lieuts. J. R. Kyle and C. H. Schildauer of the U. S. Navy. The mechanics were L. M. Woolson of the Packard company and Chief Machinist's Mate Charles Sutter. When she took off she carried a total weight of 19,500 lb. composed of 1,300 gal. of gasoline, 110 gal. of oil, the crew of four and their supplies. The course was over the Delaware River from the Philadelhia Navy Yard to Fort Delaware, about 40 mi. The take off was made at 10:22 a. m. May 1 and about twenty-eight trips were made over the course, at 1:32 p. m. May 2, she began describing circles about a mile in diameter at Philadelphia. The landing was made at 2:58 p. m. May 2. The record nearly doubles the previous record of 14 hr. 53 min. of last year. This flight demonstrates the capability of this type and the Packard engines to make the flight to Hawaii.

Porto Rico Flight

The Naval Airship Los Angeles arrived at Mayaguez, Porto Rico 6:19 p. m. May 4 and was moored to the mast on the Patoka at 7:45 p. m. She left Lakehurst at 10:45 p. m. May 3, thus making the trip in 33 hr. from mast to mast.

Short Wave Radio

A distance of 2000 mi. was successfully worked with a short wave radio set in a Navy plane in flight during a recent test held at the Naval Air Station, Anacostia, D. C. Signals from the plane, a Navy DH4B type, were heard in St. Paul, Minn., and Tampa, Fla., but were not heard at stations much nearer. The plane was in communication with the Naval Radio Research Laboratory at Bellevue, D. C., on a 20 meter wave

length up to a distance of 60 mi., at which points signals from the plane were no longer heard, later reports telling of the reception with good audibility of the signals in St. Paul and Tampa. This appears to be a peculiarity of transmitting sets using very short wave lengths. Experiments with this type of radio equipment by the Navy during the past year have shown that signals on wave lengths below forty meters have what is known as a "jump-over" effect; that is they only travel moderate distances, then disappear for a distance varying from 300 to 700 mi., reappearing at distant points.

The light weight transmitter in the plane used only two receiving tubes, and the reception of signals from the set 2000 mi. away is believed to be a record for heavier than aircraft radio equipment.

Receiving in the plane while in flight using the 20 meter wave length was possible only up to 40 mi., due to the excessive interference experienced from the ignition system of the engine. This is due to the fact that each of the 24 spark plugs of the Liberty engine with which the plane is powered acted as transmitting stations, sending out strong signals in about the same wave length of the radio set. (twenty meters) Like most spark stations these signals are very broad and difficult to tune out. Attempts are now being made to overcome this difficulty.

This development of high frequency, short wave radio equipment for use in aircraft in flight, is based largely on experiments that have been carried on for the past few months at the Naval Research Laboratory at Bellevue, D. C., the Marine Flying Field at Quantico, Va., and the Naval Air Station, Lakehurst, N. J. Experimental short wave sets at these stations operated from the ground have been able to send signals heard in New Zealand, besides being able to receive the same distance. It is hoped that the adaptation of short wave radio equipment of extreme light weight will open up a new field for the use of radio in aircraft.

Los Angeles Flight

The U. S. Naval Airship Los Angeles made her second flight to Bermuda April 21. It was hoped to take the airship from her hangar about 4:00 a. m. but a strong wind was blowing which prevented this until 12:30. She was put to the mast and took off from it at 2:38. She was first sighted over Bermuda at 2:30 a. m. April 22. She then turned seaward again and was lost to view until about 5:30. After cruising around the island for an hour she appeared over the U.S.S. Patoka at 6:30 and was moored within the hour. This mooring was made in the face of a 40 mi. wind and is the first time that any American airship has been moored under such difficult conditions.

Describing the journey, Capt. George W. Steele, executive officer of the Los Angeles, said:

"Four hundred miles out of Hamilton Harbor, which we left about 9 a. m. April 23, we began to run into strong head winds. This caused us to ascend to higher altitudes. We rose from 800 ft. to sometimes as high as 2,000 ft. Over Cape Hatteras we narrowly avoided showers and thunder storms, and the velocity of the winds fighting us increased as we proceeded northward. This caused the delay in getting back.

"The ship responded to control with remarkable smoothness. Part of the way on the return trip we played cards with greater ease than would be possible on a crack train. I slept four hours during the night and if the going was rough no one on board noticed it particularly."

All through the night as it battled the heavy winds, the Los Angeles was guided over the Atlantic by radio compass bearings from various stations. The radio operated perfectly so that at no time was the ship off its course, it was said, despite poor visibility and wind resistance.

It was just 4:25 a. m. April 24, as the sky in the East was lighting up with the first streaks of dawn, that the watchers at the home field made out the ship approaching. Lights on the mooring mast at the naval station had been burning since 11 o'clock as a beacon to aid the ship. The Los Angeles had been expected to reach her hangar at about 2 a. m.

Flying at an altitude of 1,000 ft. the ship maneuvered over the landing field, making progress with difficulty in the teeth of a strong wind. The land breeze blew at 16 mi./hr., leading the ground crew at first to believe that the shp would have to go to the mast instead of into the hangar. The ground crew stood by, however, on the chance that a lull might occur and give an opportunity to get the Los Angeles into the hangar.

This apparently was just what Comdr. J. H. Klein, Jr., pilot of the Los Angeles, had in mind. During one of the lulls in the wind the signal was given and the ship was brought down and was taken in hand by the ground crew without difficulty. Fifteen minutes after the dirigible had been safely housed the crew, still looking fresh, was dismissed.

The Los Angeles left Lakehurst for Bermuda with forty persons aboard and returned with forty-two. Two officers from the Patoka, transferred to service in Philadelphia, constitued the addition to the passenger list. Ten sacks of mail were taken to the British islands by the ship and she returned with three. The return mail arrived 30 hr. sooner than it would have come by steamship.

Navy Air Orders

Lieut. (jg) John A. Terhune, det. U.S.S. Converse to temp. duty Nav. Air Sta., Pensacola.

Lieut. (jg) John V. McElduff, det. U.S.S. Arkansas to temp. duty Nav. Air Sta., Pensacola.

Ens. James C. Guillot, det U.S.S. Brooks, to temp. duty Nav. Air Sta., Pensacola.

Ens. Wiley N. Hand, det. U.S.S. Sloat, to temp. duty Nav. Air Sta., Pensacola.

Ens. Harry E. Morgan, det. U.S.S. California to temp. duty Nav. Air Sta., Pensacola.

Lt. (jg) Joseph C. Van Cleve, det. Nav. Air Sta., Pensacola, to U.S.S. New York.

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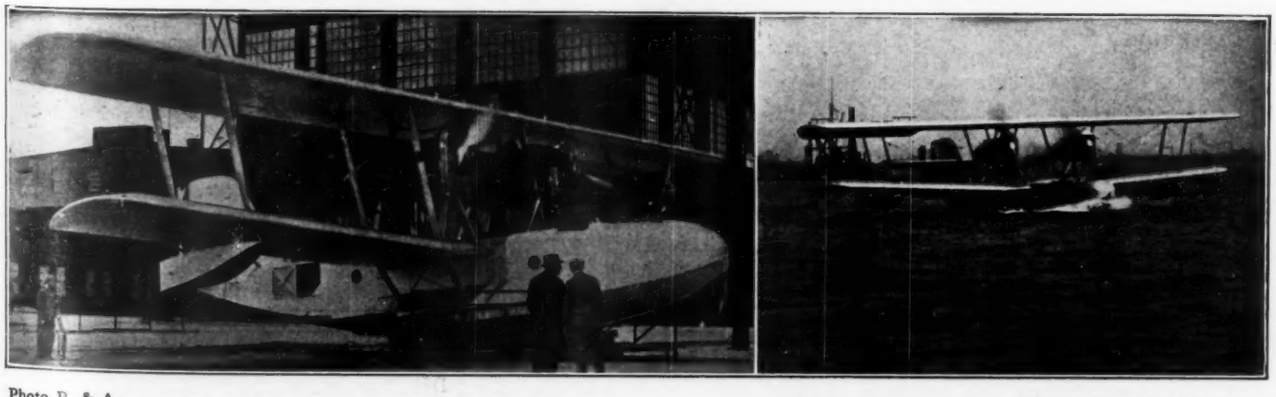

Photo P. & A. Photo International Newsreel

The PN9 on her handling truck and just after landing. The PN9 is the latest of a series of large flying boats developed by the Navy. She is powered by two Packard A1500, 500 hp. engines, described in this issue. The hull and many of the parts are made of aluminum alloy

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Publisher's News Letter

Our interest in the final disposition of the original Wright airplane is more personal than is usual in aeronautical affairs. It is an interesting story, in the light of recent public announcements concerning the final disposition of the machine. Back in 1916, when the new buildings of the Mass. Inst. of Technology were ready to be dedicated, it was planned to have an exhibition of scientific relics and trophies. It fell to our lot to have charge of the aeronautical collection. Of course, the first thought was to get the first airplane that ever flew—for once avoiding technicalities of expression. To our great surprise we learned that this priceless aeronautical treasure was not even in such condition that it could be assembled, that it was packed in boxes that had gone through the Dayton Flood, and that the machine had never been assembled since the early experiments. Mr. Wright thought that while it would be possible to assemble it in some sort of condition it would take months. Some of the parts would have to be replaced and some of the fabric renewed. Even the Aero Club of America, to whom Mr. Wright had loaned parts of the original engine, had been so careless as to permit them to become lost. The exhibition of the first airplane that man ever flew seemed hopeless.

* * * *

Knowing that the well known pioneer balloonist, Roy Knabenshue knew the situation in Dayton better than any one else, his cooperation was secured and after a few long distance telephone pleadings, Mr. Wright consented to make the attempt to assemble the original machine. As soon as his first fear of the time element was overcome, the task became a labor of love and soon the good news came that the machine was found to be in better shape than had been expected. It was exhibited for the first time publicly at the dedication of the new M.I.T. in Cambridge, Mass. Since then it has been shown several times in public, notably at the Dayton Races last year where a special building was erected to let the crowds see it. At other times it has been stored in Mr. Wright's laboratory, always in danger of destruction should any unusual fire or flood occur. But at least the machine was put in such condition ten years ago that it will always be available as one of the great scientific relics of the world.

* * * *

While reminiscing, another event in connection with the above exhibition may be mentioned with interesting memories. A dinner was given in Boston in honor of Mr. Wright to a few aeronautical visitors to the Dedication. Mr. Wright was honored by the presence of Alexander Graham Bell, Mr. Means, the editor of the first aeronautical paper in this country, Admiral Capps, Alan R. Hawley, president of the Aero Club of America, Glenn Martin, Oscar Brindley and several others who have made aviation history. For over two hours Mr. Wright and his friends talked of the early days of the airplane. From Mr. Means's paper, Mr. Wright said that he and his brother had received some of their first aeronautical data. He paid Mr. Bell the compliment of being the first man of scientific distinction in this country to publicly acknowledge his belief in the work of the Wright Brothers. It was recalled that the Wrights offered to turn over all interest in their patents to the public, if the Aero Club would raise $100,000 for the purpose. At that time the club had on its rolls a score of men who could have donated this sum without any deprivation but only a small sum was forthcoming and much of that was subscribed by Octave Chanute, another aeronautical pioneer. There have been few aeronautical gatherings where so much real aviation history has been talked over by the men who have made it.

* * * *

It is interesting to note in connection with the splendid performance of the PN9 and the Packard engine that the duration record for seaplanes was doubled. The development of this seaplane has been made at the Naval Aircraft Factory in Philadelphia. It is the lineal descendent of the F5L. To the Packard Company should go the greatest credit as endurance records depend almost wholly on the engine performance. All eyes will now turn to the Pacific Coast and await with the keenest interest the start of the great attempt to fly from California to Hawaii. Without doubt, this flight, if successful, will be the greatest ever made, outshining even the Around the World trip.—L.D.G.

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The moment it comes in from a flight it is inspected, tuned-up, refueled, and put in perfect condition for instant emergency.

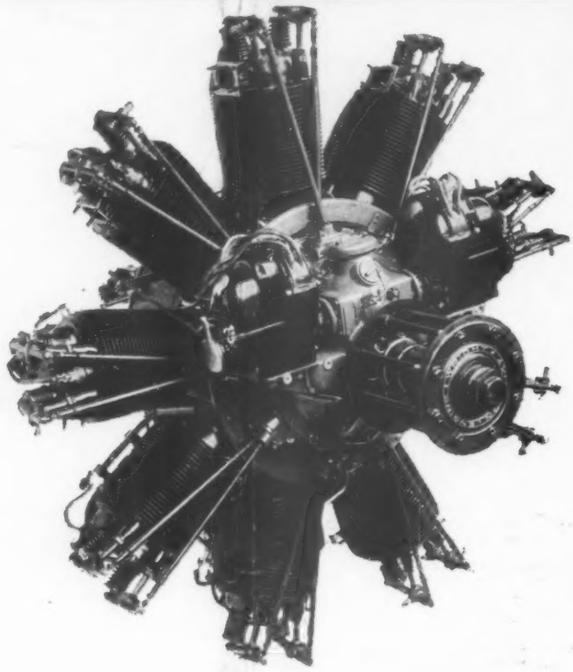
Its cargoes are unique—a big manufacturer suddenly finds himself short on a certain shipment of bolts or stampings, or needs parts for a broken air compressor—can we bring a supply at once from a city 500 miles away? — we can, and do.

Chicago's greatest newspaper wants a photograph in a tearing hurry;—out goes the little plane, with a single slip of cardboard for freight.

For more than a year this little Martin Plane has maintained an unblemished record for service. Speedy—Reliable—and as safe as a church.

THE GLENN L. MARTIN COMPANY
CLEVELAND, OHIO

Builders of Quality Aircraft since 1909



WRIGHT J-4 AIR-COOLED AERONAUTICAL ENGINE

THE only reason that air-cooled aeronautical engines have not heretofore been generally used in flying craft is because water-cooled engines were more highly developed.

The Wright Aeronautical Corporation has spent the past two years in intensive laboratory and engineering tests perfecting the present Wright "Whirlwind" series which is typified in the present Wright J-4 model.

Many governmental as well as commercial aeronautical engineers thoughout the world have followed intently each step in the development of air-cooled motors, and they now realize that all the many advantages of an air-cooled aeronautical power plant may be obtained in the Wright J-4,-200 H. P.

Bulletin No. 8 fully describing the Wright J-4 engine, together with specifications etc. will be mailed upon request.

WRIGHT AERONAUTICAL CORPORATION

Paterson, New Jersey, U. S. A.

Saves weight in power plant and plane.
Gives higher performance.
Free from radiation troubles.
Best for flying in extremely hot or cold weather.
Decreased upkeep and handling expense.

Increased flying time.
Decreased cost and weight of spare parts
Starts quickly in cold weather.
Less vulnerable to attack.
Decreased first cost.

WRIGHT J-4'S ARE JUST AS DEPENDABLE AS THE FAMOUS WRIGHT E-4

WRIGHT